The present invention relates to a set of equipment for a motor vehicle, of the type comprising:

- an inflatable structure,
- an element forming a support for the inflatable structure,
- an element forming a load-spreading plate spreading the load of an impact of an occupant of the motor vehicle with the deployed inflatable structure, and
- at least one frangible member for fixing the load-spreading plate to the support, the frangible member being intended to break as the inflatable structure deploys.

The invention applies in particular to sets of equipment comprising inflatable structures for protecting the knees of the occupants of motor vehicles.

A set of the aforementioned type is known in such an application from document US-6 131 950.

In that document, the inflatable structure comprises an open first end fixed to the support and a second end formed of an integrally formed end wall. The end wall of the structure is fixed to the load-spreading plate. This fixing is provided along the edge of the load-spreading plate by virtue of a strengthening ring stitched into the structure and housed in a rim of the load-spreading plate.

This set of equipment proves to be costly to produce because it entails a great many components and a large amount of material.

One object of the invention is to solve this problem by providing a set of equipment of the aforementioned type which costs less to produce.

To this end, the subject of the invention is a set of equipment of the aforementioned type, characterized in that the set comprises a sheath, an open first end of which is fixed to the support and an open second end of which is fixed to the load-spreading plate, the inflatable structure being formed by the sheath and the load-spreading plate which closes off the second end of the sheath, and in that the frangible member comprises a web, a peripheral region of which is fixed to a first element, either the load-spreading plate or the support, and a central region of which is fixed to the other of either the load-spreading plate or the support.

According to some particular embodiments, the set of equipment may have one or more of the following feature(s) taken in isolation or in any technically feasible combination:

- an intermediate region of the thin web, situated between the central region and the peripheral region, is a region of lower strength,
- the peripheral region of the thin web is fixed to the first element by clamping means,
- the central region of the thin web is fixed to the second element by clamping means,
- the clamping means comprise at least one end-piece with an enlarged head,
- the first end of the sheath is fixed by being trapped between the first element and the peripheral region of the thin web,
- the second end of the sheath is fixed by being trapped between the second element and the central region of the thin web,
- the first element is the support and the second element is the load-spreading plate,
- the set constitutes a set for protecting the knees of an occupant of a motor vehicle.

Another subject of the invention is a motor vehicle characterized in that it comprises a set of equipment as defined hereinabove.

The invention will be better understood from reading the description which will follow, given solely by way of example made with reference to Figures 1 to 3:

- Figure 1 being a schematic longitudinal section of a set of equipment according to a first embodiment of the invention,
- Figure 2 being a schematic perspective view of the thin web for fixing the load-spreading plate to the support of the set of Figure 1, and
- Figures 3 and 4 being views similar to Figure 1, on a smaller scale, illustrating the deployment of the inflatable structure of the set of Figure 1.

In all of that which follows, the orientations used are the customary orientations of a motor vehicle. Thus, the terms "front", "rear", "top" and "bottom" are to be understood with respect to the position of a driver of the motor vehicle and its direction of travel.

Figure 1 schematically illustrates a set of equipment 1 for a motor vehicle, in the form of a door to a storage binnacle for housing items. This storage binnacle is provided in the instrument panel. The door 1 therefore forms part of the instrument panel. It is arranged more or less facing the knees of a passenger of the motor vehicle.

The door 1 is conventionally hinged to the remainder of the instrument panel to allow access to the storage binnacle.

The elements of the instrument panel other than the door 1 are conventional. They have therefore not been depicted in the figures and will not be described in detail hereinafter.

The door 1 essentially comprises:

- an inflatable structure 2,
- a front support 4 for the inflatable structure 2,
- means 6 for inflating the structure 2,
- a load-spreading back plate 8 for spreading the load when a passenger impacts with the structure 2, and
- a frangible thin web 10 for fixing the load-spreading plate 8 to the support 4.

The inflatable structure 2, comprises, on the one hand, a sheath 12 which forms its lateral wall, and comprises, on the other hand, the central zone 14 of the load-spreading plate 8 which forms its end wall, as will be described hereinafter.

The sheath 12 is made, for example, of a braided or woven material and has an open front first end 16 and an open rear second end 18.

The structure 2 has a furled configuration depicted in Figure 1 and a deployed configuration depicted in Figure 4.

In the deployed configuration, the sheath 12 converges from its front end 16 towards its rear end 18.

The sheath 12 is then stretched between its ends 16 and 18 and extends along a directrix mid-line L that is roughly horizontal in Figure 4. The sheath 12 near its front end 16 and about the line L has a more or less rectangular outline.

Near the rear end 18 and about the line L the sheath 12 has a similar outline, but of a smaller size.

The upper region 20 of the sheath 12 is appreciably shorter, in the plane of Figure 4, than the lower region 22 of the sheath 12.

It will be understood that the abovementioned geometric features are specific to the embodiment of Figures 1 to 4 and may, in alternative forms, be absent.

The support 4 forms an interior lining for the door 1. The support 4 comprises a peripheral surround 24 internally delimiting an opening 26, and a cover 28 closing the opening 26.

The peripheral surround 24 and the cover 28 are made, for example, of plastics material(s).

The cover 28 is fixed to the surround 24 by the clip-fastening of fingers 30 which extend the cover 28 rearwards and are housed in openings 32 formed in the surround 24.

The cover 28 is arranged in front of the surround 24 and the clip-fastening has been achieved by moving the cover 28 backwards and downwards with respect to the surround 24.

The means 6 for inflating the structure 2 comprise, for example, a gas generator 6 attached to the cover 28.

The generator 6 is of conventional type and its structure will therefore not be described in greater detail hereinafter.

The generator 6 is fixed to the rear face of the cover 28 and therefore faces the load-spreading plate 8.

The load-spreading plate 8 forms, when the structure 2 is in the furled configuration and the door 1 is closed as depicted in Figure 1, a part of the exterior surface of the instrument panel and may therefore, for example, like it comprise a layer of plastics material covered with a covering skin.

As illustrated more specifically in Figure 2, the thin fixing web 10 comprises a rear central region 34 with a roughly rectangular outline, an intermediate region 36 which extends the rear central region 34 forwards and a front peripheral region 38 which extends the intermediate region 38 outwards and, for example, comprises four tabs 40, each one arranged on one side of the intermediate region 36.

The intermediate region 36 is a region of lower strength.

In one embodiment, this region of lower strength is obtained by virtue of recesses 42 made in the region 36 and between them delimiting frangible small bridges 44 connecting the central region 34 to the peripheral region 38.

This region of lower strength works in pure tension. This embodiment "with frangible small bridges" offers an advantage over the "V-shaped" weakened lines customarily used in airbag covers because as the cross sections of the frangible small bridges 44 can easily be sized, the rupture load is very repeatable, and less dependent on temperature and on structure inflation conditions.

The thin fixing web 10 has, for example, been produced by moulding a plastic material.

The peripheral region 38 of the thin web 10 is fixed to the surround 24 of the support 4. This fixing is provided in the example depicted by end-pieces 46 which extend the peripheral region 38 forwards and are housed in orifices 48 of the surround 24. The front ends 50 of the end-pieces 46 have been deformed, for example by melting, to form enlarged heads providing a rigid connection between the peripheral region 38 of the thin

web 10 and the surround 24 of the support 4. The end-pieces 46 and their heads 50 therefore form rivets clamping the thin web 10 on the support 4.

The front end 16 of the sheath 12 is trapped between the surround 24 and the peripheral region 38 of the thin web 10, thus fixing this front end 16 to the support 4.

It will be noted that the end-pieces 46 therefore pass through orifices made in the front end 16 of the sheath 12 in line with the orifices 48.

Likewise, the central region 34 of the thin web 10 is fixed to the central zone 14 of the load-spreading plate 8 by end-pieces 52 which extend the zone 14 forwards and are housed in orifices 54 of the central region 34 of the thin web 10. The front ends 56 of the end-pieces 52 have been deformed by melting to form enlarged heads. The end-pieces 52 therefore constitute rivets clamping the thin web 10 to the plate 8.

The rear end 18 of the sheath 12 is trapped between the central region 34 of the thin web 10 and the central zone 14 of the plate 8. Thus, the end 18 is fixed to the load-spreading plate 8. Furthermore, the zone 14 of the load-spreading plate 8 covers over the rear end 18 of the sheath 12 and therefore forms the end wall of the structure 2.

To produce the door 1, the sheath 12 is slipped over the thin web 10, and then the central region 34 of the thin web 10 is fixed to the load-spreading plate 8, at the same time fixing the rear end 18 of the sheath 12 to the plate 8. It will be noted that the sheath 12 slipped onto the thin web 10 is then prepositioned. In an alternative form that has not been depicted, the thin web 10 may comprise, in addition to the end-pieces

46, positioning studs intended to be engaged in openings in the sheath 12.

Next, the surround 24 is fixed to the peripheral region 38 of the thin web 10, making it possible simultaneously to fix the front end 16 of the sheath 12 to the surround 24.

Finally, the cover 28, already equipped with the gas generator 6, is fixed on, by clip-fastening onto the surround 24.

If an accelerometer, not depicted, connected to the gas generator 6 detects an impact, this triggers the operation of the generator 6. The gas produced by the generator 6 fills the interior volume of the structure 2 initially in the furled configuration, until the pressure exerted on the central region 34 of the thin web 10 is high enough to break the small bridges 44 of the thin web 10.

Once these small bridges 44 have been broken, the central region 34 of the thin web 10 is separated from its peripheral region 38 and the load-spreading plate 8 can move with respect to the support 4.

The structure 2 then begins to deploy as illustrated in Figure 3.

This initial deployment is in a direction of inflation D more or less orthogonal to the cover 28 of the support 4, and therefore inclined downwards and backwards. During this initial phase of the deployment of the structure 2, the load-spreading plate 8 therefore has a tendency to move backwards and downwards, as illustrated by the arrow 58 in Figure 3.

The diagonal d1 (in dotted line) connecting the upper edge of the front end 16 of the sheath 12 to the lower

edge of the rear end 18 of the sheath 12 will become taut before the diagonal d2 (in dotted line) connecting the lower edge of the front end 16 to the upper edge of the rear end.

The side regions of the sheath 12, which connect the upper 20 and lower 22 regions, and which will become taut along the diagonal d1 will therefore cause the load-spreading plate 8 to pivot upwards until the side regions are taut along the diagonal d2.

Thus, in the terminal phase of deployment of the structure 2, the load-spreading plate 8 no longer moves in the direction of inflation D but diverges gradually from this direction to become centred, in the deployed configuration of Figure 4, on the line L.

The load-spreading plate 8 is therefore at the end deployment of the structure situated above the direction of inflation D, properly facing the passenger's knees. The sheath 12 is then taut from its front end 16 to its rear end 18 which means that the directrix line L runs more or less horizontally at an angle θ to the direction of inflation D.

Next, when the passenger's knees strike the load-spreading plate 8, this plate spreads the load applied by the knees over practically its entire area and thus allows the structure 2 to satisfactorily deaden the impact of the passenger's knees with the instrument panel.

The set of equipment 1 described hereinabove has the following advantages.

By virtue of the use of the frangible thin web 10, the load-spreading plate 8 is attached to the support 4 without any take-up of play being needed.

Furthermore, this attachment is reliable which means that any play and outward projection that appear over time are limited. Thus, the vibrations likely to arise over time as the vehicle runs along are limited.

The aesthetic appearance of the set 1 is therefore satisfactory, and this is achieved at low cost.

Furthermore, the thin fixing web 10 is used both for prepositioning and for fixing the sheath 12 and therefore makes it possible to achieve low production costs.

Furthermore, the number of components used is low, making it possible to reduce production costs accordingly. It will also be noted that the moulding of the thin web 10 requires few moving parts in the mould and that the thin web 10 can easily be released from the mould. Its cost of manufacture is therefore low.

Even so, the thin web 10 makes it possible to achieve breakage under a relatively low and well-defined load.

In addition, the thin web 10 forms a member that strengthens the load-spreading plate 8, making it possible to reduce its thickness and therefore the cost of the set 1.

In other alternative forms that have not been depicted, the fixing of the central region 34 and of the peripheral region 38 of the thin web 10 to the load-spreading plate 8 and to the support 4 may be performed using means other than those described.

In particular, use may be made of welding and/or clip fastening techniques.

In another embodiment that has not been depicted, the thin web 10 may be connected by its central region to

the support 4 and by its peripheral region to the load-spreading plate 8.

Furthermore, the sheath 12, which is taut in the deployed configuration of the structure 2, itself forms the means of guiding the structure as its deploys, making it possible further to reduce the cost of the set 1.

It will be noted that this feature can be used independently of the use of the frangible thin web 10 and of the embodiment of the structure 2 in the form of a sheath with two open ends.

Thus, the structure 2 may be a conventional structure with an end wall formed integrally with its lateral wall, which forms the means of guiding the structure as it deploys.

More generally, it will be noted that these principles may be used to guide the structure 2 along a directrix line L which may be offset laterally and/or vertically with respect to the direction of inflation D so as to achieve the desired end position for the load-spreading plate 8.

In general also, the sheath 12 may, in addition to guiding the structure as already described, alter the orientation of the load-spreading plate 8 with respect to the support 4.

Specifically, in the example described hereinabove, the plate 8 remains more or less parallel to the support 4. However, by altering the lengths of the upper 20, lower 22 and side regions of the lateral wall of the structure it is possible to modify the orientation of the plate 8 with respect to the support 4.

In a way that is more general yet, auxiliary guide means may be associated with the guide means formed by the lateral wall of the structure which becomes taut more or less between the front end 16 and the end wall 14 of the structure. These auxiliary guide means may comprise a rim of the instrument panel which will retain the lower edge or upper edge of the load-spreading plate 8 at the start of inflation of the structure.